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ABSTRACT

Written to assist managers of child health programs, this publication explains the features and uses of a simple visual chart for monitoring childhood growth and detecting changes in nutritional and health status. The first part of the book introduces the basic principles and procedures for measuring changes in growth and knowing when these changes signal a deterioration in health. Highly practical information on the design and use of growth charts is presented. In order to ensure that growth charts are understood and properly used by community health workers, the book alerts program managers to specific problems of design, presentation, recording, or interpretation that should be considered when developing or adapting a chart for local use. Illustrations show a prototype chart and modified versions developed to meet special needs in India, Indonesia, Colombia, Thailand, and Brazil. The book also shows how such charts can be used for the education of mothers in appropriate feeding practices and the development of a medical history. The second part of the book offers guidelines for training health workers to use the chart. Information ranges from important points to stress when teaching weighing procedures to examples of cases where growth information might be misinterpreted. (RH)

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The Growth Chart

A tool for use in infant and child health care

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By means of direct technical cooperation with its Member States, and by stimulating such cooperation among them, WHO promotes the development of comprehensive health services, the prevention and control of diseases, the improvement of environmental conditions, the development of health manpower, the coordination and development of biomedical and health services research, and the planning and implementation of health programmes.

These broad fields of endeavour encompass a wide variety of activities, such as developing systems of primary health care that reach the whole population of Member countries; promoting the health of mothers and children; combating malnutrition; controlling malaria and other communicable diseases including tuberculosis and leprosy; having achieved the eradication of smallpox, promoting mass immunization against a number of other preventable diseases; improving mental health; providing safe water supplies; and training health personnel of all categories.

Progress towards better health throughout the world also demands international cooperation in such matters as establishing international standards for biological substances, pesticides and pharmaceuticals; formulating environmental health criteria; recommending international nonproprietary names for drugs; administering the International Health Regulations; revising the International Classification of Diseases, Injuries, and Causes of Death; and collecting and disseminating health statistical information.

Further information on many aspects of WHO's work is presented in the Organization's publications.

The Growth Chart

A tool for use in infant and child health care

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Preface

Growth monitoring is an important technique for identifying individuals, groups, or communities whose growth is not keeping up with the expected pattern. Poor growth, whether as a result of infection, malnutrition or other cause, and whether evident in particular individuals or in population groups, needs to be detected in order that corrective action may be taken. In this context, the individual child growth chart is widely accepted as an important and practical tool that can contribute significantly to the objective of health for all by the year 2000.

The growth chart offers a simple and inexpensive means of monitoring child health and nutritional status and can be used by community health workers with very little instruction and supervision. The chart represents a convenient means of presenting basic health data and permits the assessment of current status as well as the observation of trends in growth.

Being essentially visual, the chart also provides the health worker with a useful instrument for educating the mother and the family. It promotes a clearer understanding of the nature of growth and development, and portrays clearly the consequences of an inadequate diet and of infectious diseases. In this way it contributes to a greater acceptance of responsibility for child care by the mother and to the concept of family self-reliance in health matters.

Although the general objectives of growth monitoring are the same in all settings, the approaches and tools will vary according to the objectives of the particular child health programme, the parameters considered of greatest concern and of local relevance, the equipment and skills available, and the organization of health care services. The present publication thus describes the principles of growth monitoring and stresses the need for each health service to develop monitoring methods and a growth chart appropriate to the communities served. Several examples are given to show how this has been done in various countries. Guidelines are also given on training community health workers to fill in the chart and to interpret the growth curve correctly.

This book has resulted from the growing experience of health workers throughout the world who responded both with enthusiasm and constructive criticism to an earlier publication on growth monitoring.[1] *The World Health Organization would welcome a continuation of that criticism, as the principles and information provided here are adapted and implemented. Any comments or suggestions should be addressed to: Maternal and Child Health, World Health Organization, 1211 Geneva 27, Switzerland.*

WHO is particularly indebted to Dr M. Béhar, formerly Chief Medical Officer, Nutrition, WHO, Geneva, and Dr W. A. M. Cutting, University of Edinburgh, Scotland, for their extensive contributions to this book.

[1] *A growth chart for international use in maternal and child health care*. Geneva, World Health Organization, 1978.

Summary points

1. A growing child is a healthy one.
2. Growth is very sensitive to external factors, such as nutrition and disease, and growth monitoring is therefore of great value in child health care.
3. Malnutrition can be detected by means of growth monitoring long before signs and symptoms of it become apparent.
4. The most sensitive measure of growth is weight.
5. The most convenient way of monitoring weight is by means of growth charts.
6. For purposes of comparison, growth charts are provided with reference curves showing the limits of normal growth, since children naturally vary in size for genetic reasons.
7. Reference curves are based on data from a large sample taken from a population of well-nourished, healthy children.
8. In growth monitoring, the weight of a child is plotted on the growth chart at monthly intervals and the points joined up to form a growth curve.
9. The direction of the growth curve, rather than its position, is of key importance.
10. A rising growth curve means a healthy child.
11. A flat growth curve is a warning signal.
12. A growth curve that turns downward calls for immediate action.
13. Health workers must be trained to use the growth chart, not only in monitoring child health, but also as a tool for the health education of mothers.

Introduction

Paediatricians have long recognized that measurement of growth is a simple and useful way of monitoring the health of children. A study carried out by WHO in 1972 showed that the weighing of children was already common practice in peripheral health services in many countries and that many different growth charts had been developed. There was, however, still some confusion about certain fundamental and practical issues such as the reference values to be used and the way that the chart should be designed.

With the cooperation of experts and practitioners in different countries, WHO coordinated an effort to solve some of these problems and to promote the more widespread use of the growth chart in primary health care. The publication *A growth chart for international use in maternal and child health care: guidelines for primary health care personnel* (*1*) appeared in 1978 as a result of this work. It contained recommendations on growth standards, a prototype of a growth chart, and guidelines for the chart's use in health services. This publication stimulated the use of growth monitoring in child care. Growth charts based on the principles suggested and adapted to local circumstances and programme characteristics were developed in various countries, and have been widely used by both paediatricians and community health workers as an instrument for assessing the health of children and orienting the necessary actions.

Growth charts are also a valuable aid in teaching the mother the basic principles of child health care and obtaining her closer cooperation with the health services in this care. In some cases, the growth chart has also been used to promote community participation in child health care and to generate interest and support from national authorities.

In contrast to the 1978 publication, this book does not present detailed guidelines for the use of growth charts and does not recommend a model chart for international use. It is addressed primarily to programme managers to help them to decide as to:

- the value of growth monitoring in their child care programmes and how it can best be done in the local circumstances and in line with local programme needs and resources;
- what measures of growth should be used and what measuring instruments should be selected;
- how the chart should be designed so that it is most helpful to health workers in implementing the child care programme activities, taking into consideration the skills of the workers and the time available to them;
- how mothers can be stimulated to interpret correctly the growth curve, and to take appropriate action, when necessary;
- how the training curriculum for health workers and guidelines for the better use of the chart can be developed.

In other words, it is aimed at assisting programme managers in deciding how to develop and use an instrument that will facilitate child care programme activities and make them more effective, rather than calling for the use of a standard chart, which may not correspond to local programme needs and circumstances. It has been found that, when a chart does not meet local requirements, health workers have often resisted using it or have simply neglected it.

This publication should be complemented by guidelines for the use of the chart addressed to personnel at different levels and, if appropriate, to mothers; ideally, such guidelines should be developed locally. Model guidelines intended to be adapted locally are included in another WHO publication, entitled *Guidelines for training community health workers in nutrition* (*2*).

This publication will be useful to those responsible for planning and managing activities aimed at preserving one of the greatest assets of any nation – its children's health.

Part 1

Principles of growth monitoring and the growth chart

A growing child is a healthy child

A child is by definition a growing individual. At birth, the size of the infant is the result of growth during the intrauterine period of life. From then on there is a progressive increase in size until the child reaches adulthood. This process is influenced by factors of two types: (1) genetic or hereditary; and (2) environmental or external. The genetic factors include ethnic characteristics and the size of the parents, particularly of the mother. They are fixed, cannot be modified, and will regulate growth from conception to adulthood.

The environmental factors include primarily nutrition, infections, intoxications, and other deleterious external influences that can prevent the growth potential with which individuals are genetically endowed from being fully realized.

These environmental factors can start to act during intrauterine life; for instance, severe malnutrition of the mother or heavy smoking during pregnancy will result in the newborn being of smaller size than would otherwise have been the case.

After birth, the influence of the external factors on growth becomes even more important because the child is more directly exposed to them. Infant and child diet is, of course, of primary importance. Any form of marginal or deficient supply of nutrients interferes with growth. Infections and other diseases act in a similar way.

Because of the sensitivity of growth to external influences, its careful, continuous observation can be a valuable tool for monitoring the health of a child. Growth faltering can be detected in a child long before any easily observable signs or symptoms of malnutrition become evident. Similarly, it can be the first manifestation of an infection or other disease. Growth monitoring can therefore enable an early diagnosis of health problems to be made and timely corrective measures instituted.

The severity of a health problem can also be assessed by its influence on growth. A chronic or unclearly defined health disturbance in a child should not give rise to very great concern as long as the child is growing adequately.

A knowledge of what adequate growth is, how it can be properly observed, and how deviations from it can be recognized in good time is therefore extremely useful in child care.

What to measure

Three main types of anthropometric measure are commonly used as indicators of size: length or height, weight, and various body circumferences. They all have advantages and disadvantages depending on the use to be made of the measurements and the facilities available for making them.

Length or height

Length (height) is a very stable measure that reflects the total increase in size of the child up to the moment that it is determined, and therefore its total previous health history; however, it changes too slowly to be used in growth monitoring.

It is also a fairly difficult measurement to make, particularly in infants and small children, for whom monitoring is of greatest value. The possible inaccuracies, associated with the difficulties in making the measurement, make it much more difficult to detect differences between two values determined within a short time interval.

Furthermore, length or height does not decrease and therefore cannot indicate a deterioration in health.

Weight for age

The relative change of weight with age is more rapid than that of height and is much more sensitive to any deterioration or improvement in the health of the child.

Significant changes can be observed over periods of a few days. Making the measurement is easy, so a high level of accuracy is possible. It is for these reasons that weight for age is the measure usually employed in growth monitoring, particularly in infants and young children. One possible disadvantage is that it may be affected by abnormalities in body composition, for instance by the development of oedema, and this may confuse its interpretation. Particular attention should therefore be given to this possibility when dealing with severely malnourished children; however, it should not interfere with the early detection of malnutrition, one of the main reasons for carrying out growth monitoring.

Weight for height

By relating the weight of a child to its height or length an objective measure of the child's degree of thinness can be obtained.

Weight for height is more specific in this respect than the measurement of weight alone, which does not distinguish between a tall, thin child and a short, fat one. However, for monitoring the progress of an individual child, weight for height has no advantage over weight for age.

Where the child health services are not able to carry out periodic monitoring and children are seen irregularly or only once, weight for height is of value. Because it is independent of age, it can be used in populations where children's ages are not known.

A height/weight chart that can be fixed to a wall or table has been developed (*3*) and is available from UNICEF.

Body circumferences

The circumferences of the head or thorax may be of specific clinical significance, but for health and particularly nutritional assessment the mid-arm circumference has been recommended.

Arm circumference can be a useful measure for assessing thinness and therefore advanced malnutrition, particularly under field conditions when weighing is impracticable.

It could thus be of value in screening large populations, for instance, when it is necessary, under field conditions, to identify those children in greater need of nutritional assistance. Simple, appropriate technology has been developed for measuring it. Although changes in arm circumference seem to follow fairly closely those in body weight, it is a less sensitive measure for monitoring purposes even than height.

Normal variability

Normal variability is an important concept in the correct interpretation of body size and growth.

Children of the same sex and of exactly the same age, although all equally healthy and well nourished, have different weights – some are smaller, some bigger.

These differences may be related to individual characteristics of genetic origin, and have no health significance whatsoever.

In the weight-for-age chart obtained by plotting the weights of a sample of healthy children against age, a curve drawn in such a way that exactly 50% of the points are above it and 50% below it is called the 50th percentile or median (Fig. 1). On this chart, the limits of normal variability are indicated by a curve in the upper part, such that 97% of all points lie below it (97th percentile), and one in the lower part, leaving only 3% of the points below it (3rd percentile). In other words, the 3% of children above the upper limit and the 3% below the lower limit are regarded as exceptional—very big or very small—and are therefore not included in the "normal" range.

Since the main purpose of the growth chart is to identify children who, for health or other reasons, are not growing well, the two curves mentioned above may not be the most appropriate.

In the WHO prototype growth chart (see Fig. 2), the upper reference curve represents the 50th percentile for boys (slightly higher than that for girls) and the lower one the 3rd percentile for girls (slightly lower than that for boys).

The chart is thus suitable for use for the above-mentioned purpose and can be used for both sexes. As the only purpose of the reference lines in the chart is for comparison, any one or several such lines could be utilized.

Choosing a reference population

The normal growth of children in a given population can be determined in two ways: (*a*) a group of well-nourished, healthy children are followed from birth to a specific age and weighed at frequent intervals (prospective or longitudinal

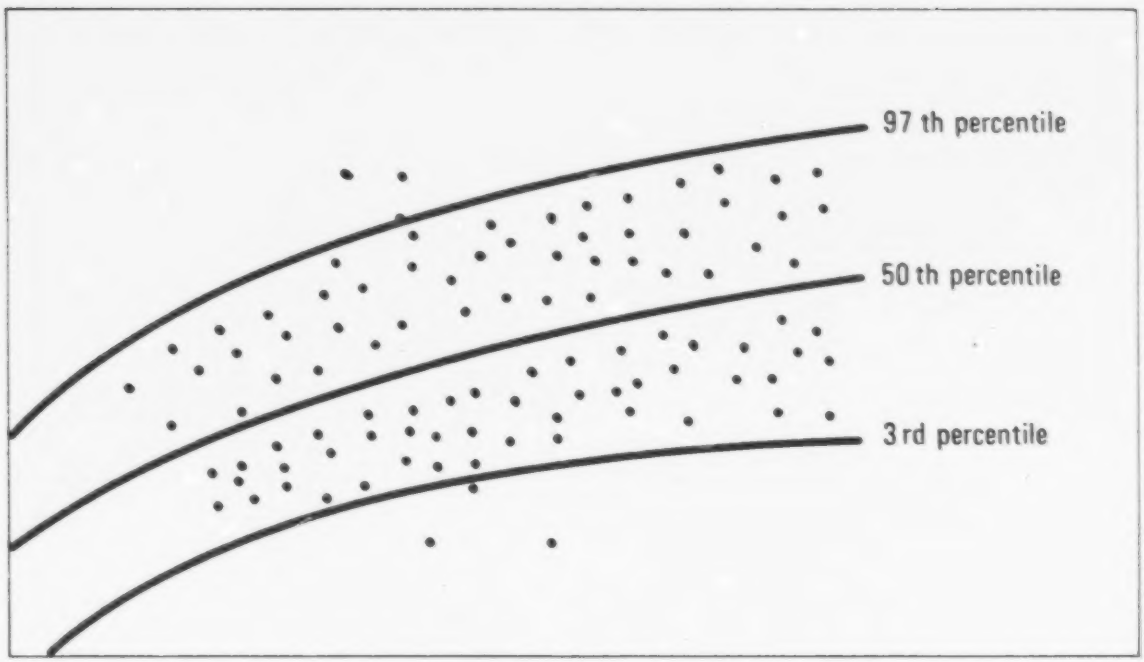


Fig. 1. Diagram showing 3rd, 50th, and 97th percentiles

method); and (*b*) children of all ages within the desired range (0–5 years of age, for example) are weighed once (cross-sectional method).

For reasons of convenience the second method is usually adopted. The cross-sectional approach has its limitations in that children who have passed through a period of inadequate growth cannot be identified and excluded from the analysis of the data.

Data to be used as reference values should meet the following conditions (*4*):

- The measurements should be made on a sample drawn from a well-nourished population.
- The sample should include at least 200 individuals in each age and sex group.
- The sampling procedures should be defined and reproducible.
- The measurements should be carefully taken and recorded by trained observers, using equipment of well-tested design and calibrated at frequent intervals.

In the United States of America, data have been assembled by the National Center for Health Statistics (NCHS) that meet most of the above criteria (*5*). Centile distributions and the median plus and minus 1, 2, and 3 standard deviations have been calculated for the distribution by the Centers for Disease Control. There are separate sets of data from two different child populations: for the 0–36-month age group, from studies made at the Fels Research Institute, Yellow Springs, Ohio; and for the 2–18-year age group, from national samples of the National Center for Health Statistics.

The suitability of the NCHS values for use as international standards has been questioned. It has been suggested that it may not be valid to compare the growth of Asian or African children with that of children in the United States of America because of racial differences in growth patterns. However, it has been found that children living under optimal environmental conditions in many different developing countries have growth patterns very closely resembling those corresponding to the NCHS data. This observation was confirmed when the WHO prototype chart was tested in various countries (*1*).

It is believed that any weight differences between children from different countries that might be due to race would be relatively small in comparison with the large differences actually observed due to environmental factors (infectious diseases and insufficient dietary intake).

A. Face of chart

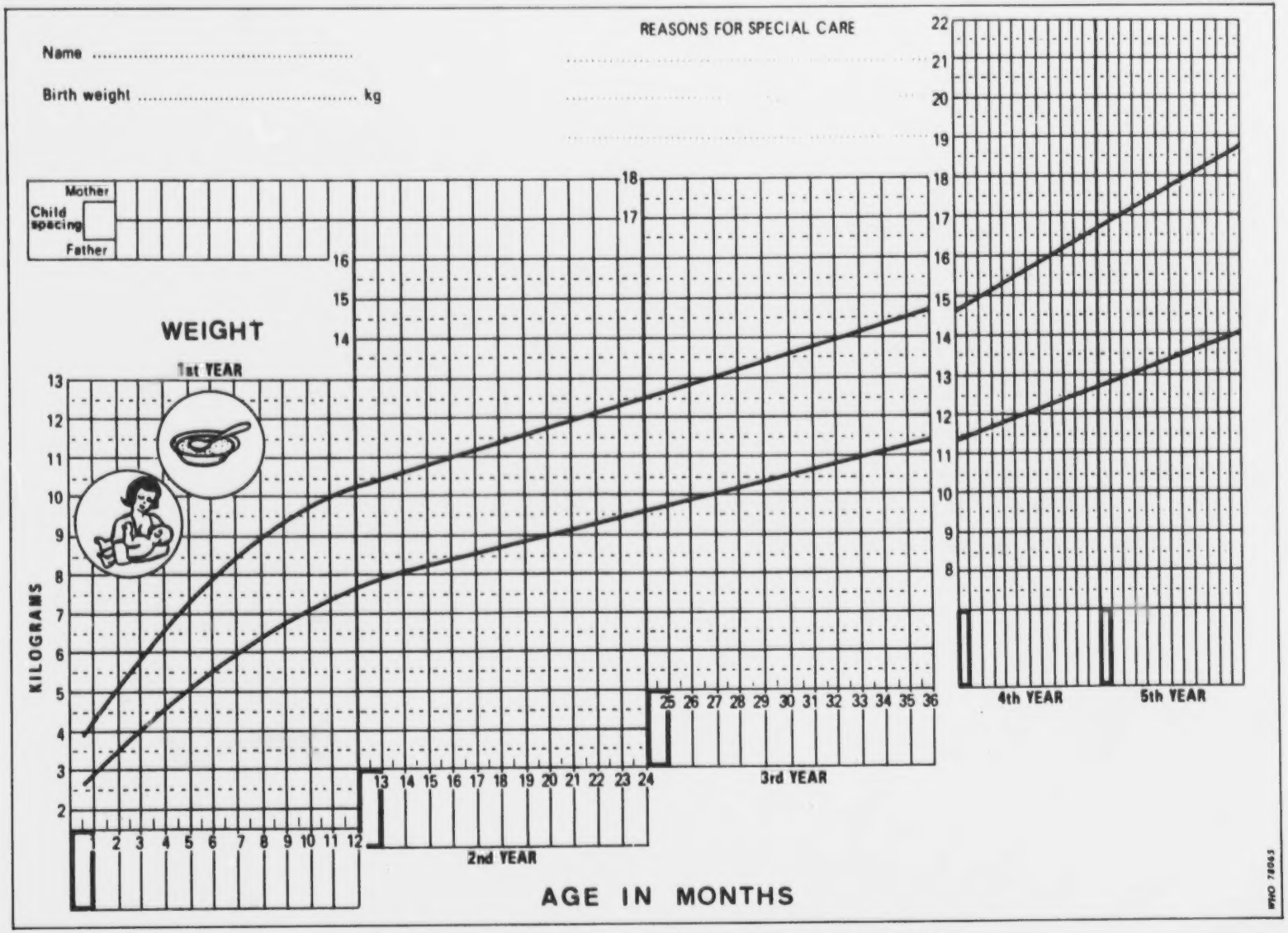


Fig. 2. WHO prototype growth chart (face) (for reverse, see Fig. 12)

When to measure

A growth chart is designed primarily for the longitudinal follow-up of a child, so that changes in weight over time can be interpreted. A single measurement of the weight of a child may be very difficult to interpret properly without additional information. Periodic weighing is therefore necessary and a decision has to be made as to the periodicity.

The first measure should be obtained at birth or as soon as possible afterwards. The birth weight is itself of great importance in diagnosis and prognosis (a subject that will not be discussed here), and for the purpose of growth monitoring it is extremely useful in the proper interpretation of the future pattern of growth.

Children who are small at birth, if their smallness is not due to prematurity or to intrauterine malnutrition, will usually remain small; they will follow a curve running parallel to but below the median. Without the information on birth weight, the small size of such a baby could be misinterpreted as being due to insufficient dietary intake or other health problems.

How frequently children should be weighed after birth must be decided in the light of the other activities scheduled (e.g., immunizations), the ability of the mothers to attend the health centre or clinic, the time available to the personnel for this purpose, the health workers' schedule for home visiting, etc., and, for the individual case, the health condition and health risks of the child.

Ideally, children should be weighed at least once every month during the first year, every two months during the second year, and every three months thereafter up to five years of age, the first three years being the most critical period.

In addition to this schedule, however, every child should be weighed and the weight plotted on the chart every time he or she is brought to the health service for any reason, particularly if the child is sick.

Personnel should see the weighing as a diagnostic tool, valuable both at the time of the consultation and in the follow-up.

When the child is first seen a long time after birth, the first weight measurement should be interpreted with the help of a carefully taken history, including, if possible, the weight at birth (or an approximation to it) and any other previous weight measurement, as well as a physical examination. Subsequent periodic weighing should substantiate the original interpretation.

Types of chart

The essential feature of a growth chart is a graph on which weight is plotted against age so that growth can be followed graphically in comparison with reference standards. The design of the graph should be carefully thought out so as to facilitate its use (plotting of periodic weight-for-age measurements) and interpretation (growth rate and deviations from growth pattern).

Weight units are marked on the vertical axis; these are usually kilograms, but if another unit (e.g., pounds) is normally used in the locality and the balances to be employed are graduated in that unit, it may be preferable to use it in the graph. Subdivisions of half a kilogram are useful in increasing the accuracy of the values plotted. The horizontal axis shows the age of the child, usually from birth to 5 years, divided into months and subdivisions of half a month, again in order to facilitate accurate plotting.

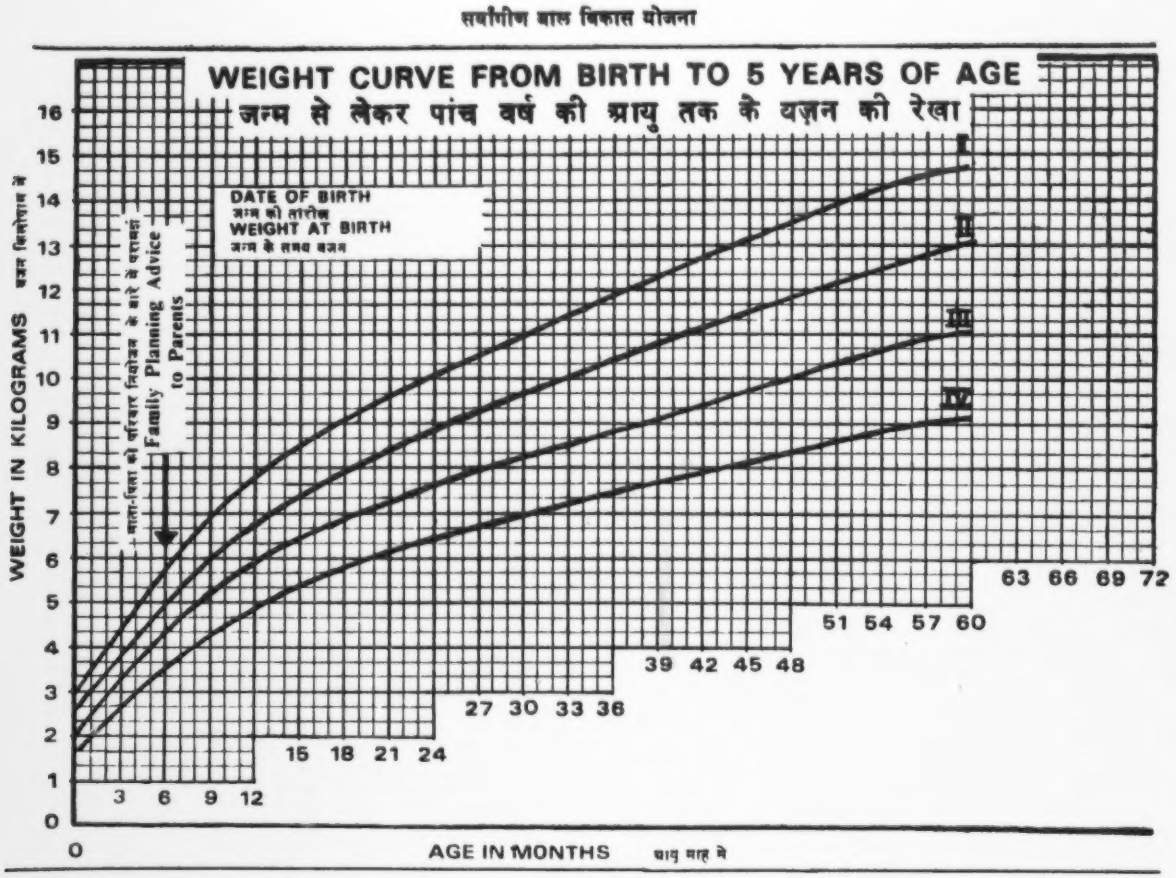
It has been found useful to give more space to the first three years of age, and to compress the fourth and fifth, because the younger the child the more rapid its growth and the greater the sensitivity to deviations; weighing should therefore be more frequent during this initial period.

The type of calendar used in the WHO prototype chart is that originally proposed by Morley (*6*), which has the advantage, if it is properly used and the month of birth has been determined, of giving the age of the child automatically whenever his or her weight is measured subsequently.

Running diagonally across the graph are curves representing reference values. As indicated previously (see page 10), the WHO prototype growth chart has two curves, the upper corresponding to the 50th percentile of the reference standard and the lower to the 3rd percentile (see Fig. 2).

Some charts have been prepared with more than two curves (Fig. 3 and 4), leaving narrow spaces (channels) between them. The intention is to emphasize the fact that different children follow different channels and to facilitate the visual appreciation of deviations from a growth curve and changes of channel; colours having the connotation of health or disease in the local culture have been added. In another chart, developed in Indonesia (Fig. 5), the coloured bands indicate the limits of "normality" and different degrees of malnutrition.

The use of colours and channels could help to bring home to the mother the fact that her child's


सर्वांगीण बाल विकास योजना
WEIGHT CURVE FROM BIRTH TO 5 YEARS OF AGE
जन्म से लेकर पांच वर्ष की आयु तक के वज़न की रेखा
DATE OF BIRTH
जन्म की तारीख
WEIGHT AT BIRTH
जन्म के समय वजन
Family Planning Advice to Parents
WEIGHT IN KILOGRAMS
AGE IN MONTHS
I
II
III
IV
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72

सूचना.—(१) मुलाचा जन्म महिना व वर्ष रेषेच्या सुरुवातीला लिहा. मुलांच्या जन्माच्या वेळचे वजन व जन्म महिना यांच्यात तुलना करा. ज्या ठिकाणी वजन व वय ह्या रेषा एकमेकांना छेदतात तेथे खुण करा. नंतर त्या छेदलेल्या दोन्ही रेषा एकमेकांना रेषेच्या साहाय्याने जोडा.

सूचना.—(२) सदृढ बालकांचे वजन पहिल्या रेषेवर असावे. ज्या बालकाचे वजन रेषा एक व दोन या मध्ये असते. अशा बालकाच्या आईला सकस आहाराचे शिक्षण व माहिती देऊन त्याप्रमाणे त्याचा उपयोग घरी करावा. ज्या मुलाचे वजन दोन व तीन या रेषेच्या खाली आहे त्या बालकाची काळजी अंगणवाडी कर्मचाऱ्यांनी घ्यावी व त्याप्रमाणे सकस आहार द्यावा. ज्या अर्भकांचे वजन तिसऱ्या रेषेपेक्षा खाली आहे त्यांनी लवकर इलाज करावे. डॉक्टरांना भेटून त्यांचा सल्ला घ्यावा आणि ज्यांचे वजन चौथ्या रेषेपेक्षा खाली आहे अशा बालकाला दवाखान्यात औषध व उपचारासाठी ठेवून घ्यावे.

Fig. 3. Growth chart in use in India, showing use of several reference curves to indicate the nutritional status of the child

curve is moving in a wrong and dangerous direction, but it might, on the other hand, present problems of interpretation and give rise to unnecessary concern in the case of small children who are growing normally but whose growth curve lies on a low percentile. In contrast, naturally large children who may not be growing well may fail to arouse concern because their growth curves are nevertheless still within the limits of "normality".

Many other examples could be mentioned (see Fig. 6 and 7); all have certain advantages and disadvantages.

Programme managers will have to find a suitable compromise between complexity and ease of use and interpretation, in accordance with the programme objectives and with due consideration of cost, the skills of the workers, the time available, the need for understanding on the part of the mothers, and other local circumstances.

The chart must include a proper identification of the child. The following information may also be included:

- important care interventions (e.g., immunizations, family planning) (see Fig. 2 and Fig. 5–7);
- a graphic reminder of action to be taken at particular times (Fig. 8, page 19);
- family data and other information that may influence the child's health (risk factors) (Fig. 9, page 19);
- events of significance for the health of the child (e.g., spacing between siblings, diseases, chemoprophylaxis, dietary changes) (Fig. 10 and 11, page 20).

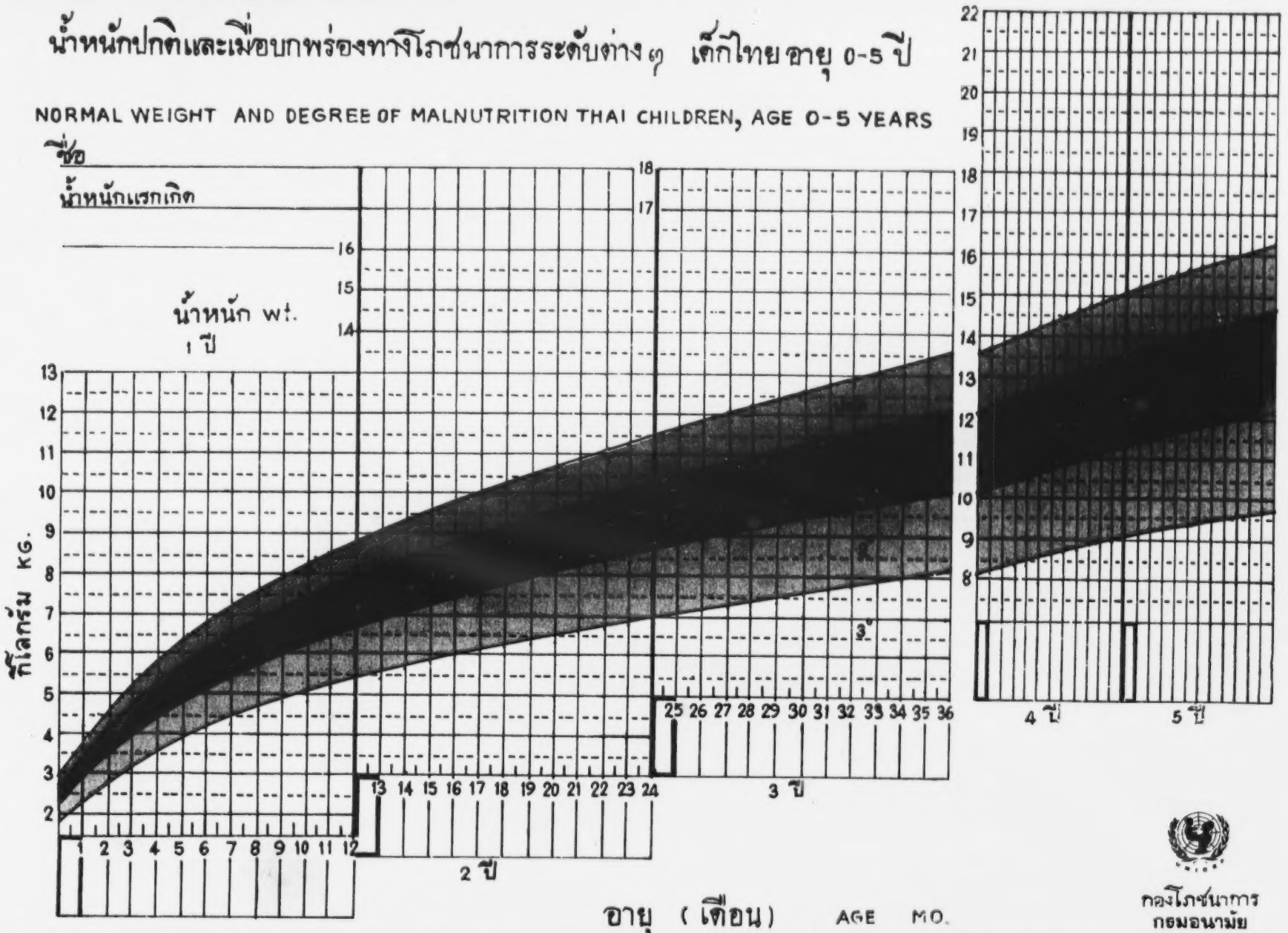


Fig. 4. Thai growth chart, showing use of several growth curves and colours to indicate the nutritional status of the child

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17-A

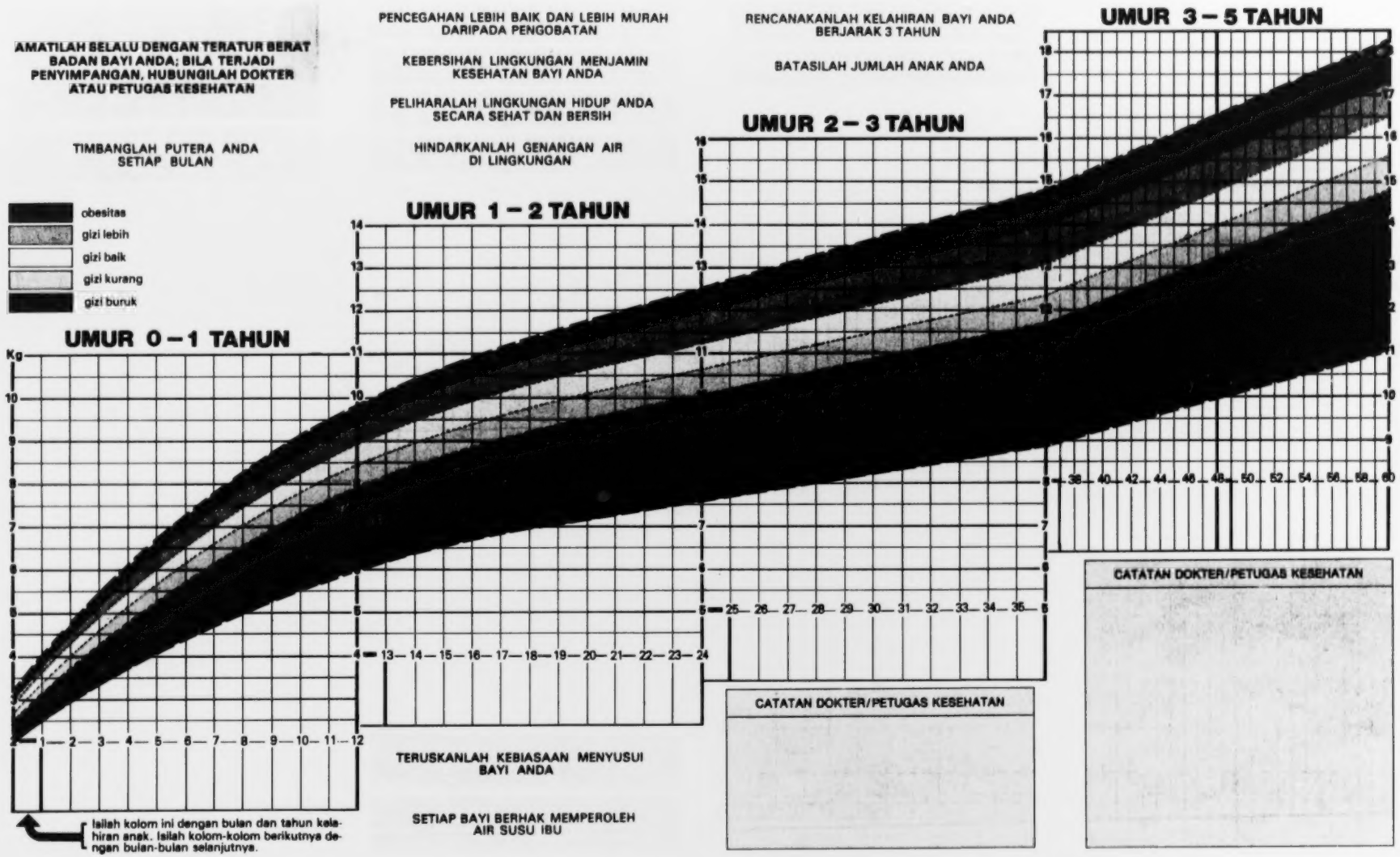

AMATILAH SELALU DENGAN TERATUR BERAT BADAN BAYI ANDA; BILA TERJADI PENYIMPANGAN, HUBUNGILAH DOKTER ATAU PETUGAS KESEHATAN
TIMBANGLAH PUTERA ANDA SETIAP BULAN
PENCEGAHAN LEBIH BAIK DAN LEBIH MURAH DARIPADA PENGOBATAN
KEBERSIHAN LINGKUNGAN MENJAMIN KESEHATAN BAYI ANDA
PELIHARALAH LINGKUNGAN HIDUP ANDA SECARA SEHAT DAN BERSIH
HINDARKANLAH GENANGAN AIR DI LINGKUNGAN
RENCANAKANLAH KELAHIRAN BAYI ANDA BERJARAK 3 TAHUN
BATASILAH JUMLAH ANAK ANDA
obesitas
gizi lebih
gizi baik
gizi kurang
gizi buruk
UMUR 0 – 1 TAHUN
UMUR 1 – 2 TAHUN
UMUR 2 – 3 TAHUN
UMUR 3 – 5 TAHUN
Kg
CATATAN DOKTER/PETUGAS KESEHATAN
CATATAN DOKTER/PETUGAS KESEHATAN
Isilah kolom ini dengan bulan dan tahun kelahiran anak. Isilah kolom-kolom berikutnya dengan bulan-bulan selanjutnya.
TERUSKANLAH KEBIASAAN MENYUSUI BAYI ANDA
SETIAP BAYI BERHAK MEMPEROLEH AIR SUSU IBU

Fig. 5. Indonesian growth chart, showing use of several growth curves and colours to indicate the nutritional status of the child

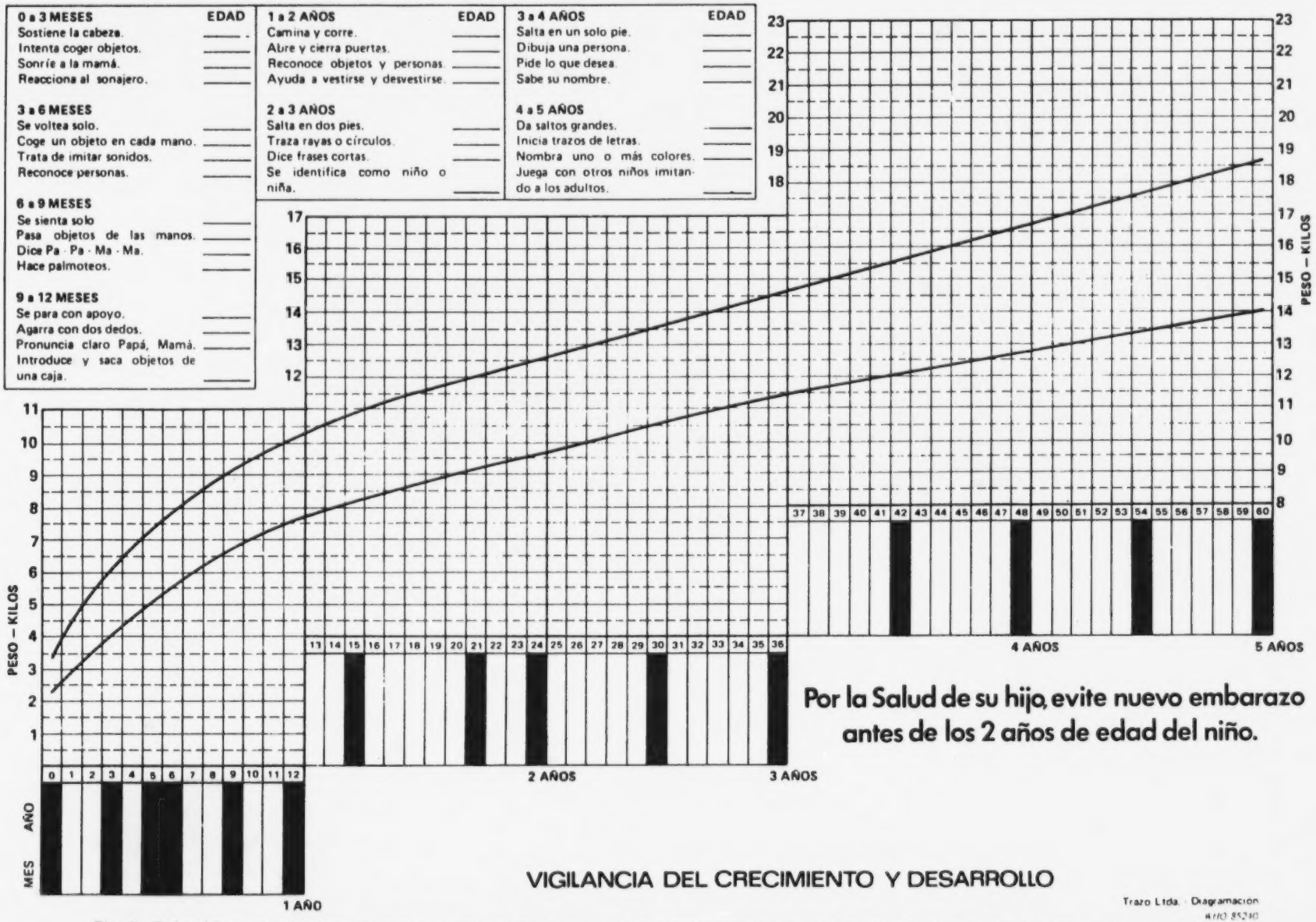

0 a 3 MESES EDAD
Sostiene la cabeza.
Intenta coger objetos.
Sonríe a la mamá.
Reacciona al sonajero.
3 a 6 MESES
Se voltea solo.
Coge un objeto en cada mano.
Trata de imitar sonidos.
Reconoce personas.
6 a 9 MESES
Se sienta solo
Pasa objetos de las manos.
Dice Pa - Pa - Ma - Ma.
Hace palmoteos.
9 a 12 MESES
Se para con apoyo.
Agarra con dos dedos.
Pronuncia claro Papá, Mamá.
Introduce y saca objetos de una caja.
1 a 2 AÑOS EDAD
Camina y corre.
Abre y cierra puertas.
Reconoce objetos y personas.
Ayuda a vestirse y desvestirse.
2 a 3 AÑOS
Salta en dos pies.
Traza rayas o círculos.
Dice frases cortas.
Se identifica como niño o niña.
3 a 4 AÑOS EDAD
Salta en un solo pie.
Dibuja una persona.
Pide lo que desea.
Sabe su nombre.
4 a 5 AÑOS
Da saltos grandes.
Inicia trazos de letras.
Nombra uno o más colores.
Juega con otros niños imitando a los adultos.
PESO – KILOS
MES AÑO
1 AÑO
2 AÑOS
3 AÑOS
4 AÑOS
5 AÑOS
Por la Salud de su hija, evite nuevo embarazo antes de los 2 años de edad del niño.
VIGILANCIA DEL CRECIMIENTO Y DESARROLLO
Trazo Ltda. - Diagramación

Fig. 6. Colombian growth chart. This also gives information on child development and advises the mother not to become pregnant again until the child is two years old

18-B

18-C

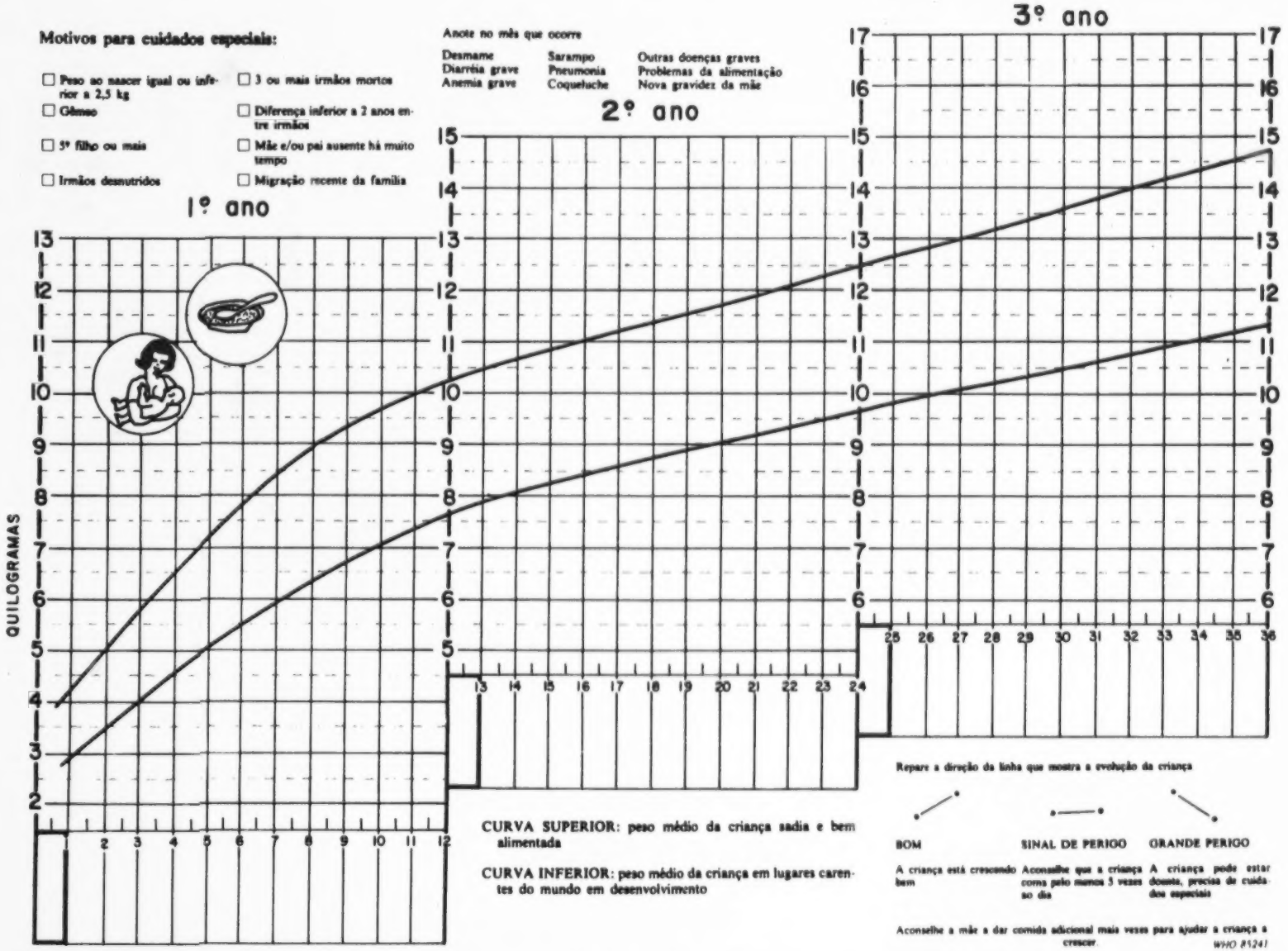

Motivos para cuidados especiais:
☐ Peso ao nascer igual ou inferior a 2,5 kg
☐ Gêmeo
☐ 5º filho ou mais
☐ Irmãos desnutridos
☐ 3 ou mais irmãos mortos
☐ Diferença inferior a 2 anos entre irmãos
☐ Mãe e/ou pai ausente há muito tempo
☐ Migração recente da família
Anote no mês que ocorre
Desmame
Diarréia grave
Anemia grave
Sarampo
Pneumonia
Coqueluche
Outras doenças graves
Problemas da alimentação
Nova gravidez da mãe
1º ano
2º ano
3º ano
QUILOGRAMAS
CURVA SUPERIOR: peso médio da criança sadia e bem alimentada
CURVA INFERIOR: peso médio da criança em lugares carentes do mundo em desenvolvimento
Repare a direção da linha que mostra a evolução da criança
BOM
A criança está crescendo bem
SINAL DE PERIGO
Aconselhe que a criança coma pelo menos 5 vezes ao dia
GRANDE PERIGO
A criança pode estar doente, precisa de cuidados especiais
Aconselhe a mãe a dar comida adicional mais vezes para ajudar a criança a crescer
WHO 81241

Fig. 7. Brazilian growth chart. The significance of the two reference curves is explained, as well as that of the direction of the child's growth curve

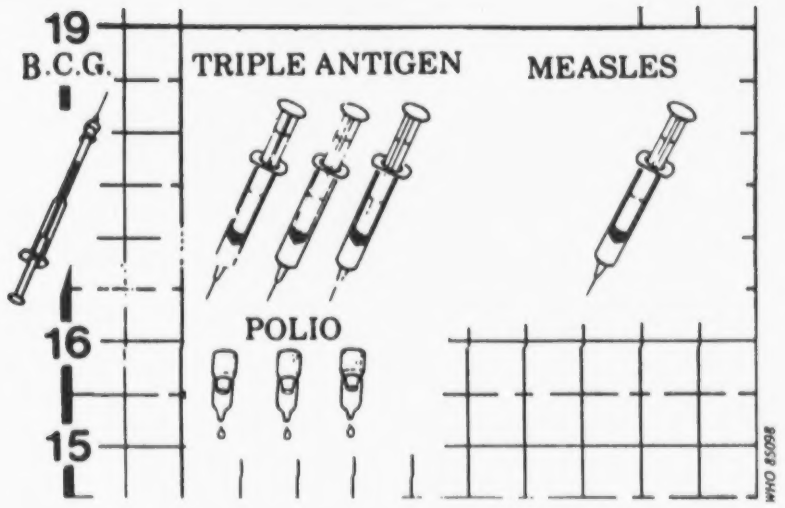


Fig. 8. Illustrations on the growth chart as reminders of the appropriate time to give immunizations

The decision as to what to include, in addition to the identification data, should be based on the programme for which the chart has been prepared, taking into consideration the need to leave enough space to permit easy and clear recording. Only information that is going to be used should be recorded. Efforts should be made to ensure that events, instructions, etc., are recorded with the minimum of writing; the maximum use should be made of symbols, graphical representations and checking of boxes, provided that these indications are clearly understood both by the health workers and by the mothers and that they are adapted to the local culture.

Important events, such as diseases, treatment, or dietary changes, can be recorded on the graph itself, in the appropriate age column, above the growth reference curves. Appropriate feeding instructions can also be included on the graph; these may be represented graphically or in any other way that is easy to understand, and should always be adapted to local practices and food availability, and consistent with the programme recommendations.

Special prophylactic measures, such as malaria prophylaxis or periodic vitamin A administration, may usefully be recorded on the chart, either in a special space provided for them or above the graph, depending on the importance of the activity in the programme. Child-spacing methods can similarly be included.

The tendency to record too much, thus making the chart difficult to read, should be avoided. It should always be remembered that the information recorded must have a use. The chart should be a tool for diagnosis, a reminder to the health worker of actions to be taken, and an educational instrument for the mother and family.

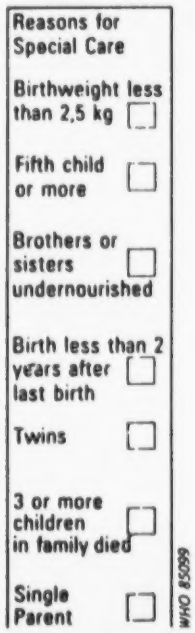

Reasons for Special Care
Birthweight less than 2,5 kg
Fifth child or more
Brothers or sisters undernourished
Birth less than 2 years after last birth
Twins
3 or more children in family died
Single Parent
WHO 85099

Fig. 9. List of risk factors that may influence the child's health

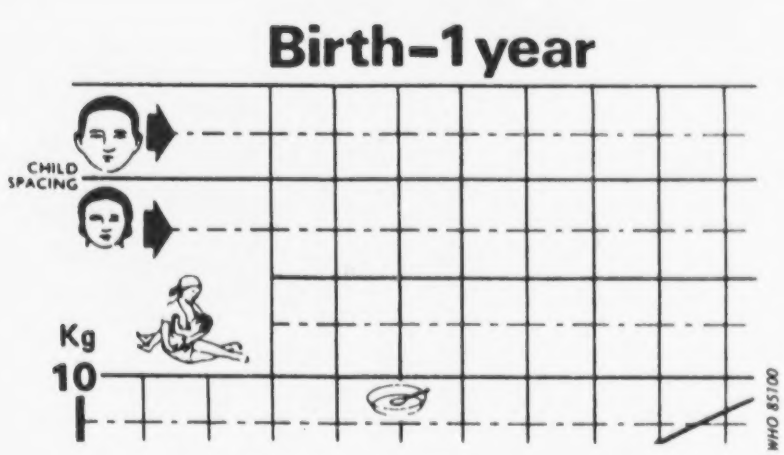


Fig. 10. Recording of child-spacing

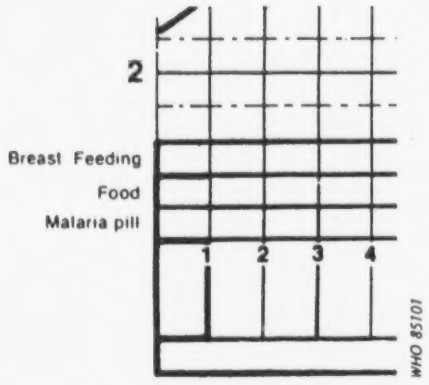


Fig. 11. Recording of breast-feeding, the introduction of solids, and malaria prophylaxis

Fig. 12 shows the reverse of the prototype chart developed by WHO, in which most of the above components are included.

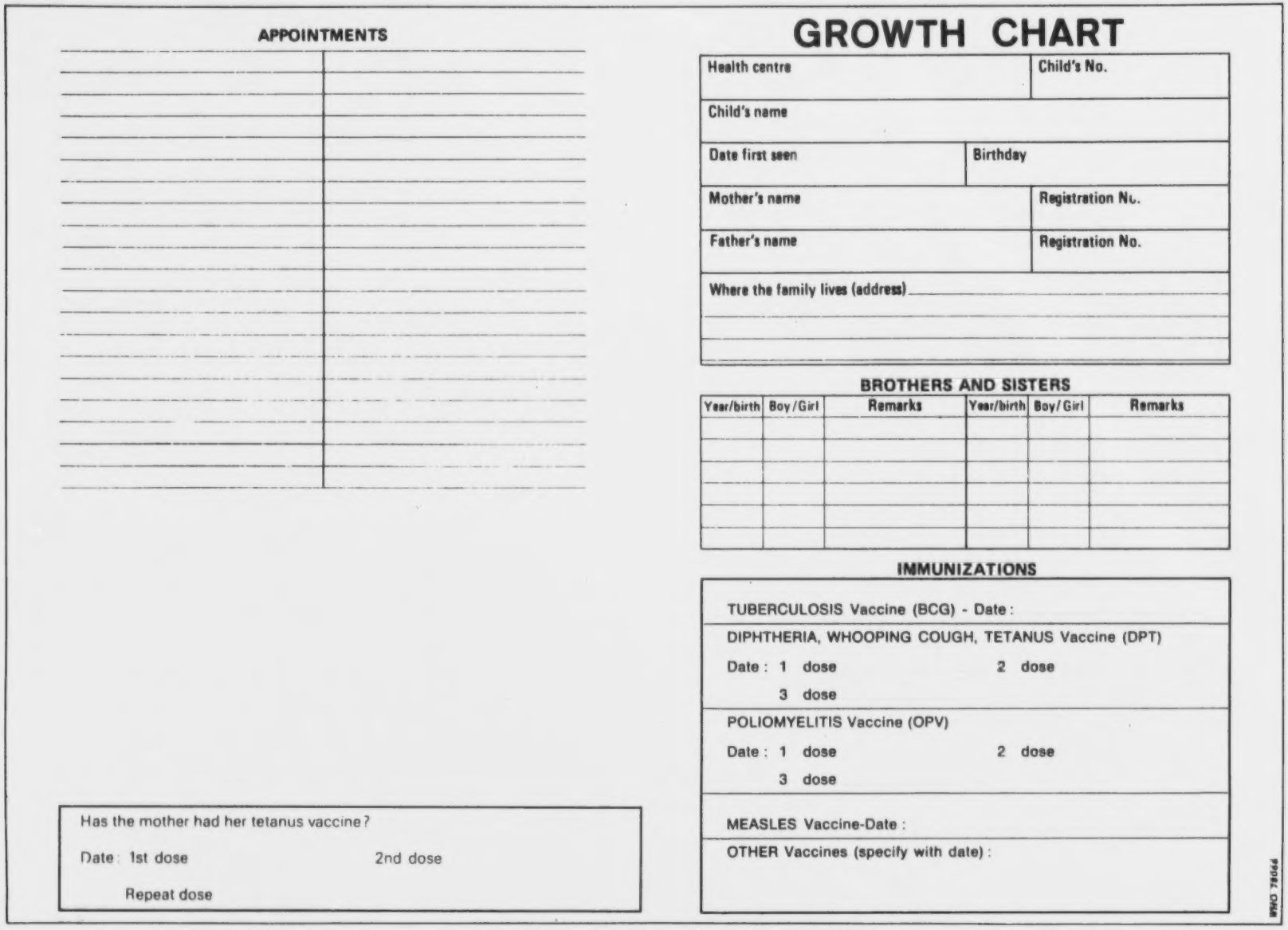
Useful suggestions as to the layout of the chart and its use have been made elsewhere (*7*). A technical review of growth monitoring, which includes an analysis of a number of different growth charts, has been published by the American Public Health Association (*8*).

Designing the chart

The chart should be printed on material strong enough to withstand five years of frequent use. Since the chart is primarily a home-based record, a plastic envelope in which it can be kept is useful. The chart should be big enough for the spaces between the lines of the grid to be clearly distinguished and the points corresponding to the monthly weighings should be far enough apart for the direction of the growth curve to be readily appreciated. The size of a standard sheet of writing paper (for instance international standard A4 size, 297 × 210 mm) has proved to be adequate and convenient for the suppliers. This also allows enough space for recording the desired additional information.

Since one of the main purposes of the chart is to educate the mother and encourage her to participate more actively in growth monitoring, it has been found useful to have duplicate charts for each child: one, on thick card, is kept by the mother, who brings it with the child at every consultation; a second, on thin card, is kept by the health service. If this proves to be impracticable because of the extra work involved in keeping two charts up to date or because of the extra cost, and only one chart is provided, this should be given to the mother and all the information of interest to the health service contained in it kept in the ordinary service records.

As far as the design of the chart itself is concerned, the following recommendations are made:



APPOINTMENTS

GROWTH CHART

Health centre	Child's No.
Child's name	
Date first seen	Birthday
Mother's name	Registration No.
Father's name	Registration No.
Where the family lives (address)	

BROTHERS AND SISTERS

Year/birth	Boy/Girl	Remarks	Year/birth	Boy/Girl	Remarks

IMMUNIZATIONS

TUBERCULOSIS Vaccine (BCG) - Date :

DIPHTHERIA, WHOOPING COUGH, TETANUS Vaccine (DPT)

Date : 1 dose 2 dose

3 dose

POLIOMYELITIS Vaccine (OPV)

Date : 1 dose 2 dose

3 dose

MEASLES Vaccine-Date :

OTHER Vaccines (specify with date) :

Has the mother had her tetanus vaccine?

Date : 1st dose 2nd dose

Repeat dose

PFIZER CHILD

Fig. 12. WHO prototype growth chart (reverse)

(1) The weight-for-age graph should be printed on one full side of the chart.

(2) The first three years, when growth is more rapid and weighing more frequent, should cover two-thirds of the space available. The next two years should fit into the remaining third of the card.

(3) In each of the year panels, sufficient boxes should be included to cover the expected range of weights of children of that age.

(4) Weights should be expressed in the unit commonly used in the area (e.g., kg or lb).

(5) Unbroken lines should be used to indicate each kilogram (or approximate equivalent) while dotted lines should be used for half kilograms.

(6) The calendar should be divided into months, which should be numbered. The box for each month should be long enough to allow the name of the month and the year to be inserted in it. The year should be mentioned in the first box and at the beginning of each subsequent year.

(7) A short line at the top of the month box can be used to divide the boxes into two-week intervals. This will make it easier to plot weights on the chart in accordance with the period of the month in which the child is seen.

Fig. 13. Beam balance for children under five years old

Choosing a scale

Since the weight of a child provides very useful information in assessing its health status, it is important that weighing should be as accurate as possible, particularly when measurements are made at short intervals to monitor growth.

What type of scale should be used? This is the first major decision to be made in ensuring that weighing is accurate. Careful consideration should be given to this question, to which there is no general answer. How and where the scale is going to be used—whether at home or at the health centre— the local conditions, the cost, the durability, and the maintenance facilities are among the considerations to be taken into account in making the choice.

Scales of two different types are generally available, namely beam scales and spring scales. In general, beam scales are more accurate and have greater durability, but they are also heavier and more difficult to transport. Two types of beam scale are commonly used, the first being the clinic model. For infants, this can be placed on a table and is fitted with a pan in which the infant can be comfortably placed (Fig. 13), while for older children and adults, it is placed on the floor and is provided with a platform on which the child can stand while being weighed (Fig. 14); both are very convenient when used in a fixed position but are expensive. The second type is the hanging beam scale or bar scale (Fig. 15), traditionally used as market scales in many countries and recently adapted to weighing small children with the aid of a locally made sling in which the child can be safely placed. It is easier to transport, particularly if made of lightweight metal, and cheaper than the clinic scales.

Spring scales have been more popular because they are compact, small, easy to transport and easier to read; they do not, however, retain their accuracy with prolonged use. There are two types of spring scale, the dial-faced (Fig. 16) and the tubular (Fig. 17), the first being easier to read but more expensive.

Whatever the model selected, it should be remembered that, for monitoring the weight of children under 5 years of age, the capacity should be at least 25 kg. The scale should be accurate to at least 250 g, but preferably to 100 g. Scales should be fitted with an adjusting mechanism enabling the needle to be returned exactly to zero when the scale is empty and after the hanger or towel in which the child is to be placed has been attached.

A good scale is a good beginning but its proper use is even more important. Personnel should therefore be carefully trained in the weighing procedure (see page 26).

How to use the growth chart in monitoring child health

The growth chart is primarily designed as a means of monitoring and interpreting changes in weight over time. A single measure of the weight of a child cannot by itself be properly interpreted on the chart. Ideally, the chart should be used from birth. A curve running from the birth weight of the infant, marked on the first column of the chart at the level of the corresponding weight, to the points representing the subsequent periodic weighings (at least at monthly intervals during the first year) represents the pattern of growth of that particular infant and is an excellent indicator of its health and nutritional status.

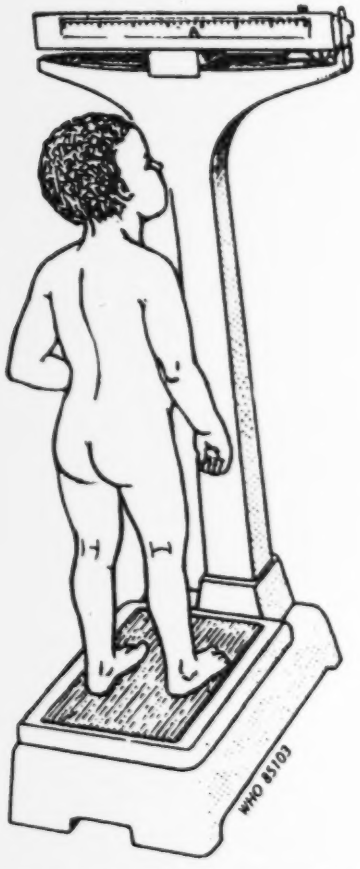


Fig. 14. Beam balance for preschool and older children

Fig. 15. Bar scale and comfortable sling seat for weighing young children

Children growing normally will follow curves running parallel to the reference curves.

When the median and the 3rd percentile are used as references, the curves for the large majority of healthy children will lie between or above these reference curves. Some may, however, be just below the lower curve, but if growth is at the same rate and in the same direction as the reference curve, and there is no clinical reason for concern, no action is needed. The children in question should be observed closely but it is likely that they are simply small, healthy children.

When some children are first weighed, the corresponding point on the chart may be low because they are very thin (low weight for height).

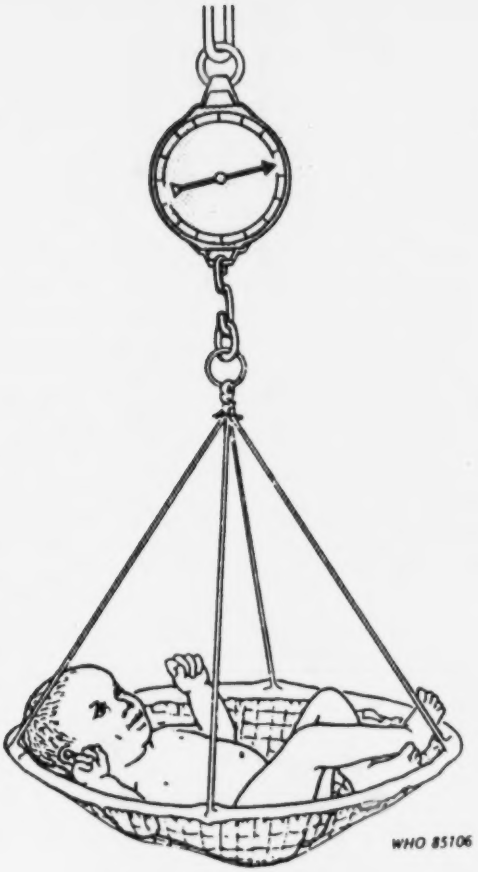


Fig. 16. Spring scale with a dial

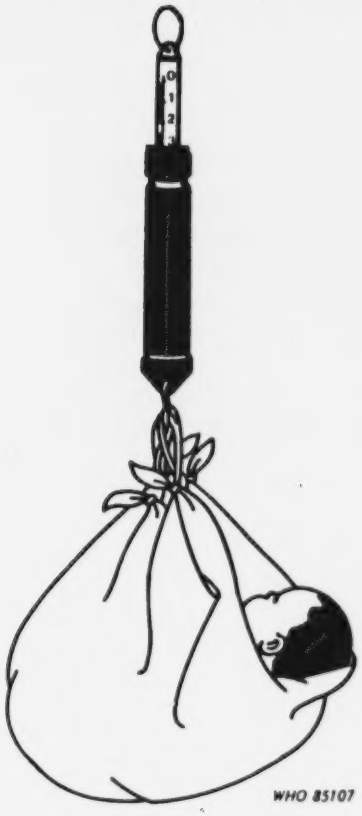


Fig. 17. Tubular spring scale for weighing newborns and infants

The weight-for-age chart does not take height into consideration; this is one of its limitations, but the problem arises mainly on the first examination. If children are followed up, with periodic weighing, and are becoming thinner, this will show up in their growth curves. A child may also have a low weight for age because he is retarded in height (stunted) as a consequence of malnutrition at an early age; such a child may not be malnourished at the time of the examination.

A single point representing the weight of an infant at a particular time is not by itself sufficient for the diagnosis of malnutrition particularly in older children, when the chances of a combination of low weight for age with normal weight for height are greater. What is important is not the weight of the child at a given age but the path by which that weight was reached (see Fig. 18).

Fig. 18 shows how any point on a growth curve can be arrived at in three ways. If it is arrived at from above, as in A, the present situation should be a cause for concern. Although still within the limits of "normal" weight for age, the child is losing weight—an indication of poor health; his own normal pattern of growth would probably run higher in the graph. If the curve is as shown in B, the child is growing normally and the growth curve is parallel to the reference curves; he is therefore doing well. If the curve is as shown in C, the child is growing at a faster rate than expected, which probably indicates that he is recovering (catching up) from the effects of malnutrition or some other cause of underweight.

It is therefore only by following children over time, with periodic weighing, that growth curves can be properly interpreted and used as a diagnostic tool for preventive or corrective action. If, for example, a child fails to gain weight for two months or more his growth curve will become flat. This is an alarm signal regardless of the position of the curve in relation to the reference curves. It is equally bad for a big child not to gain weight as it is for a small one; both should normally be growing at the same rate.

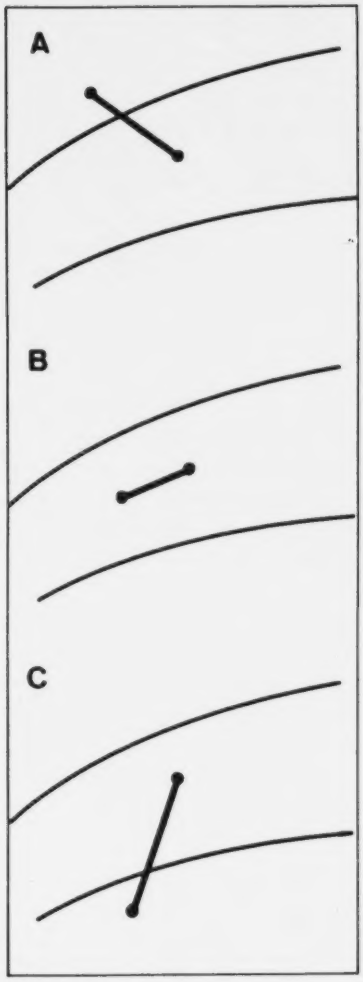


Fig. 18. Section of growth chart showing how the same point can be reached from three directions
A–from above; B–horizontally;
C–from below

Obviously if the growth curve of a child drops, i.e., he weighs less than he did on a previous occasion, something is wrong with his health. In order to facilitate the identification of growth faltering, and to show the mother that the child has changed position, charts with many narrower channels, sometimes coloured, have been developed, e.g., the Indonesian chart (Fig. 5). Their possible advantages should be carefully balanced against their higher cost and the possibility of confusing even more a chart that many mothers find difficult to interpret, particularly in cultures not accustomed to this type of symbolism.

The full interpretation of a child's growth curve requires a carefully taken history and a clinical examination.

Nevertheless any person, even with little or no training in health, if taught to use the chart properly, should be able to see the warning signs indicating that something is going wrong. This will frequently be possible before the child shows any other signs or symptoms.

Furthermore, the graphical representation, once understood, helps in the evaluation of growth without the need to remember how much a child should gain in weight at different ages — something that even physicians tend to forget.

In addition to its use in monitoring and guiding the care of the child by both the health service and the mother, the chart can provide a useful record of important health-related events. Information on the health history of the child that the mother may forget and that is important for his care, e.g., diseases suffered and immunizations received, will be recorded whenever the mother takes the child to the health centre, hospital, or day-care centre.

Part 2

Training health workers to use the chart

As with any other instrument, appropriate training is essential for the correct use of the growth chart.

At the end of the training, the health workers should be able to:

— understand the concept of growth and the factors that promote or retard normal growth;
— weigh an infant or child accurately;
— record the weight on the growth chart used in the service;
— insert correctly any other information required in the chart;
— assess normal growth on a growth chart;
— assess deviations from normal growth on a growth chart;
— interpret deviations in terms of health status;
— translate the information on the growth chart into appropriate advice and action;
— recognize the need for, and make decisions regarding, the referral of patients to a higher level of the health system;
— use the growth chart as an integral part of the health care system;
— explain to mothers the use and significance of the growth chart.

The training should therefore cover the items discussed below.

Child growth

Emphasis should be placed on the factors affecting growth, with special reference to the role of diet and the effects of disease on child growth. A better understanding of the process of growth and development may be obtained by using examples taken from the local setting (e.g., the growth of plants and the role of water and fertilizers; the growth of animals).

The weighing procedure

Health workers should be given an opportunity to become familiar with the scale that they will be using. The proper weighing procedure should be explained to them, with particular emphasis on the following points:

- The scale should be checked each time it is moved by verifying that it reads zero when empty and checking the reading for a known weight.
- The needle should be adjusted to zero before each weighing session.

Instructions should be given on how to place the scale, how to place the child on the scale, and how to obtain a correct reading.

A useful exercise when training a group of health workers is to make them all measure the same weights and then compare the results; individual members of the group should also measure certain weights repeatedly and again compare the results. The great variations usually found will convince them of the importance of careful weighing and stimulate their interest; the variability is significantly reduced after proper training. It is useful to repeat this exercise periodically.

Plotting the weight

Health workers may not be used to graphical representations and plotting graphs. The correct way to record a weight-for-age point on the graph should be carefully explained and practised.

The use of aids (e.g., a ruler, a sheet of paper) will be appropriate in the local setting. It must be emphasized that, whenever the child is weighed, the health worker must put a dot representing the weight at the point where the column of boxes corresponding to the current month meets the horizontal line corresponding to the weight. A line should be drawn from the previous dot to this new one, since the purpose of plotting the dots is to find the direction of the line formed by them. Particularly when the weighings are very close together (at intervals of less than two months), the dot should be located in a way that indicates the

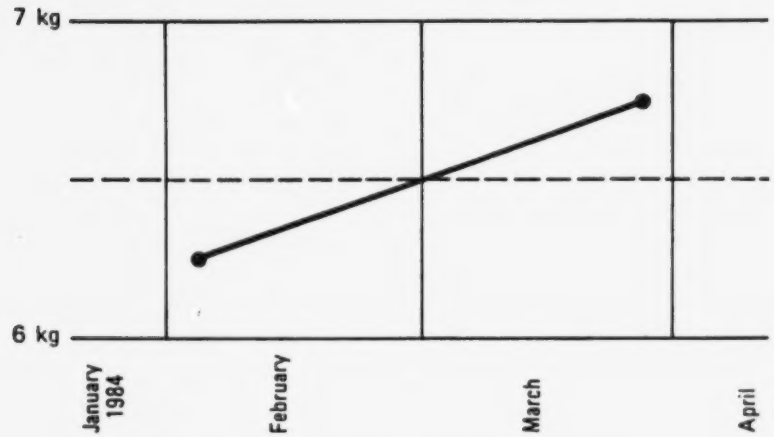


Fig. 19. Section of growth chart showing how to place the dots correctly (for discussion, see text)

period of the month, i.e., closer to the left-hand side of the box if the child was weighed during the first 10 days of the month, in the middle if he was weighed between the 10th and the 20th day of the month, and closer to the right-hand side of the box if he was weighed after the 20th day. To assist in plotting the points, the chart may have dotted lines printed on the graph to represent half kilograms. If the weight to be plotted is between half a kilogram and a full kilogram it should be plotted to the nearest 250 g. An example is shown in Fig. 19 for a child who attended clinic on the 3rd of the month and weighed 6.300 kg, and returned on the 25th of the following month and weighed 6.700 kg. As will be seen from Fig. 19, if the weights had not been plotted to the nearest 250 g the direction of the line joining the two dots would have been very different. For instance, if the two weighings had been approximated to the nearest half kilogram the line would have been horizontal; alternatively, if the first had been approximated to 6.0 kg and the second to 7.0 kg the line would have been much steeper. Similarly, if the two dots had been placed in the middle of the corresponding month columns, the line would again have been steeper. It should be emphasized that it is the direction of this line that is important, since it indicates the child's growth.

Filling in the rest of the information

Qualified health workers will probably already have experience of keeping patient records; most of the information recorded on the growth chart will therefore be familiar.

Each of the components of the chart should be reviewed with the workers and the following points discussed with them:

- precisely what information should be recorded in each place;
- why it is recorded and its present or future use;
- how the information should be obtained;
- how it should be recorded.

Any possibility of misinterpretation or cause of errors should be analysed, taking into consideration the level of understanding of the workers, their cultural and educational background, and the background of the mothers they are going to work with.

The workers should then practise filling in the chart, either with imaginary cases or with real ones, under supervision. Familiarizing workers with the chart, giving them confidence in their ability to fill it in correctly and an understanding of its purpose, will ensure that it is used properly.

The convenience of recording directly on the graph events that may affect the child's growth, such as diseases or drastic changes in diet, should be explained. Such events can be recorded in the vertical column corresponding to the month in which they take place (See Fig. 20).

Using this information, and by examining the relationship between the various events and the changes in the direction of growth, the health worker will be able to discuss with the mother what she can do to help her child. He or she could discuss, for example, the use of oral rehydration therapy at home and the importance of hygienic food preparation. The information recorded will also be useful to other health service personnel in interpreting the growth curve.

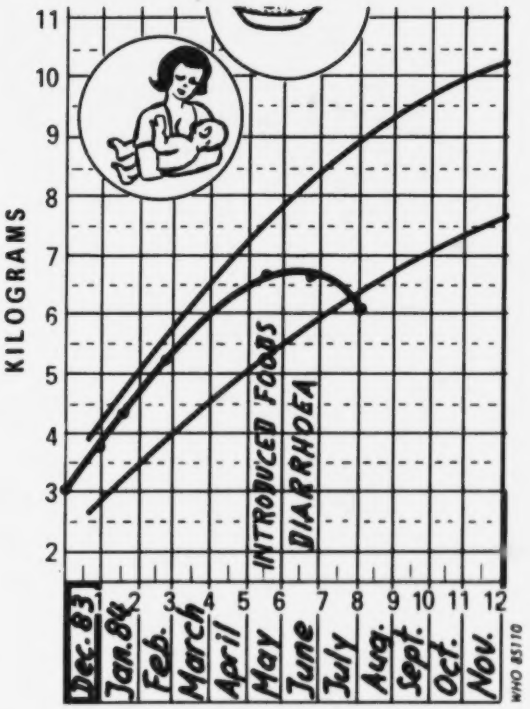


Fig. 20. Recording of diseases or changes in feeding

The corresponding fundamental messages for the health worker and for the mother are the following:

(1) If a child's growth curve is climbing upwards in the same direction as the reference curve, this is good. The child is growing adequately.

(2) If the growth curve is horizontal, this means the child is not putting on weight. He has stopped growing. Because all healthy children put on weight as they grow, this is a warning sign.

(3) If the growth curve is moving downwards, the child is losing weight. This is very dangerous. The child needs immediate help.

The direction of the curve should also help in evaluating the effectiveness of corrective measures. For instance, if the growth curve of a child is found to be like that shown in Fig. 23 as a consequence of acute diarrhoea, oral rehydration and progressive refeeding are indicated. When the child is seen one month later, the direction of the curve should have changed to a steeply rising one (catch-up growth), as shown in Fig. 24. On the other hand, if it is found that, although the child is clinically better, his growth curve has become horizontal (see Fig. 25), this is a danger sign; it may indicate that the infection persists or that the child has not been properly fed after the attack of diarrhoea.

Interpreting the growth chart

Health workers should be trained to interpret the growth chart and to explain its significance to mothers. The interpretation is based essentially on the direction and position of the growth curve.

Direction of the growth curve

The central purpose of the growth chart, with its reference curves, is to provide a visual representation of the growth of individual children. It cannot be emphasized too strongly, during the training of health workers, that the growth curve is of vital importance, both as a diagnostic tool and as an educational tool for mothers, in promoting appropriate growth and stimulating and guiding preventive and corrective actions.

It must again be stressed that the direction of growth is of prime importance. The growth curve can take three directions, as follows:

(1) upwards (Fig. 21);
(2) horizontal (Fig. 22);
(3) downwards (Fig. 23).

Position of the growth curve

The *direction* of the growth curve of a child (upwards, horizontal or downwards) is what matters. The position of the curve in relation to the reference curves printed on the chart is important only in respect of children of different sizes who are growing normally but following their own "channels". This should be explained to health workers, since it is particularly important for them to reassure mothers who may become concerned if the curves of their children are in a lower position than those of their friends' children.

If small children whose growth is following a low "channel" are active and clinically healthy, and their growth curves are running parallel to the reference curves, there is no cause for concern.

Only children whose growth curves are well below the lower reference curve, particularly if they seem to be moving still further away from it, need to be carefully examined because they may be suffering from a congenital defect or a chronic condition that is responsible for their small size and insufficient growth.

Fig. 21. Section of growth chart showing upward direction of growth curve—good

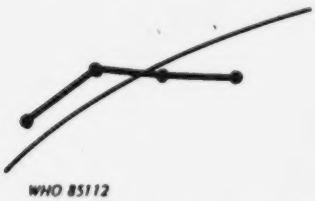


Fig. 22. Section of growth chart showing horizontal growth curve—warning sign

Fig. 23. Section of growth chart showing downward direction of growth curve—dangerous

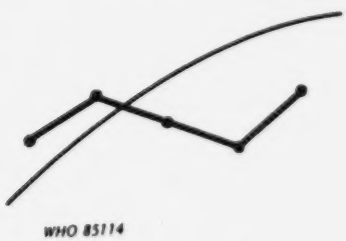


Fig. 24. Catch-up growth

Fig. 25. Faltering of growth—warning sign

When children who have not been followed since birth are first weighed, they may be found to be small for their age because of past malnutrition. This can be confirmed by taking a history and conducting a clinical examination; such children should be carefully followed, particularly if their growth curves tend to be flat. If these children are properly fed and cared for, their growth curves may turn upwards in relation to the reference curves (catch-up growth), until they reach a new channel that they follow thereafter.

It is also important to remember that, in the weight-for-age chart, the height of the child is not taken into consideration. If the child has a low weight, not because he is small but because he is very thin, this may be due to malnutrition. This question arises particularly when a child is seen for the first time. If the child has been followed and his weight for age monitored by means of the chart, his growth curve would have become flat or turned downwards as he became thin. The advantages of growth monitoring, as compared with any single measurement at a particular time, are again obvious.

Use of examples

Examples should be used to illustrate the importance of the direction of growth as compared with the position of the growth curve on the chart. Thus Fig. 26, for instance, shows the growth curves of two children, both plotted on a single chart for purposes of comparison. The first child (Child A) grew very well during the first two years of life and his growth curve always remained well above the upper reference curve. In fact, there were periods when his growth curve was rising more rapidly than the reference one, i.e., he was becoming fat. This child was sent away to live with a foster mother when his own mother remarried. During the first six months with his foster mother he failed to grow, but nobody noticed this, because he was a fat child. Then he contracted measles and lost a lot of weight in just a few weeks. He was eventually admitted to hospital with kwashiorkor, but his weight for age was still above the upper reference curve. The second child (Child B) was a low-birth-weight baby who was fed artificially, suffered frequent bouts of diarrhoea, and failed to grow adequately. At one year he developed marasmus. At the nutrition rehabilitation centre, where he and his mother spent several months, the mother, with help from the nutrition staff, learned how to feed her child. The

baby then began to gain weight. He grew steadily for the next 12 months and by the time he was 2½ years old his growth curve was just above the lower reference curve and he was in very good health.

If the position of the child's growth curve on the chart alone was taken as the main indicator of health, the first child would appear to be healthier, but this was true only during the first year. The mistake would be even greater if only the last point on the curve was considered. By looking at both children's direction of growth, however, the real situation of the two children throughout their life becomes clear.

A tool for action

Teaching health workers the use of the growth chart will not be complete without clear and precise indications as to the actions required in particular circumstances.

To go into detail on what the health worker should do as the natural follow-up of growth monitoring is beyond the scope of this publication. Such decisions will depend very much on the local conditions, i.e., the capabilities of the worker concerned, the resources available to the local health service and to the community, the nature of the health problems, etc.

The growth chart should not be seen solely as another tool for use in implementing child care activities. It can also be used in teaching, for instance, in demonstrating: (1) the importance of adequate feeding, how to achieve it, how to detect problems and what should be done about them; (2) the deleterious effects of diarrhoeal or other common diseases, and the necessary preventive and corrective measures; and (3) the value and timing of immunizations, and of all the other activities associated with child care.

Health workers will use the growth chart effectively only if they know that it increases their ability to make timely and adequate diagnoses and helps them in deciding what to do, particularly under difficult circumstances.

When referral is being considered, for example, the growth chart can provide valuable arguments in favour of such a decision and will also help to make the referral easier and more effective by identifying the reasons for it and providing the required background information to the service to which the child is referred.

The growth chart can also be an excellent tool for strengthening the interaction of health workers with mothers in the child-care activities carried out by the health services. It has also been successfully used to stimulate communities to participate in the health services' activities.

With help and practice, health workers will become familiar with the growth chart. There are, however, a number of ideas and activities involved in the use of the growth chart that health workers have found particularly difficult to understand or perform correctly. The major problems encountered include:

(1) an inability to record the child's age accurately;
(2) difficulties in determining the month of birth;
(3) incorrect weighing;
(4) inaccurate plotting of the child's weight for age;
(5) difficulties in understanding the reference curves;
(6) problems with understanding the concept of a child "at risk";
(7) difficulties in interpreting the child's growth curve;
(8) difficulties in taking effective action.

Particular care and extra time should be taken by the instructor to ensure that the trainees understand the concepts and are competent users of the chart. The different exercises should be repeated after health workers have had practical experience in using the chart, when they may have questions or need advice on matters that were not covered during the original training.

Supporting the health workers

In addition to preparing or obtaining the appropriate growth chart and training the health workers in its use, programme managers should ensure that the workers are given adequate technical and logistic support. Technical support will include guidelines on where to weigh the children —should this be in the health facility? in their homes? in a given place in the community? What children should be monitored? Should the weighing be done every day or in every child clinic as a routine whenever children are examined? Or should special weighing sessions be organized? How frequently should the children be weighed?

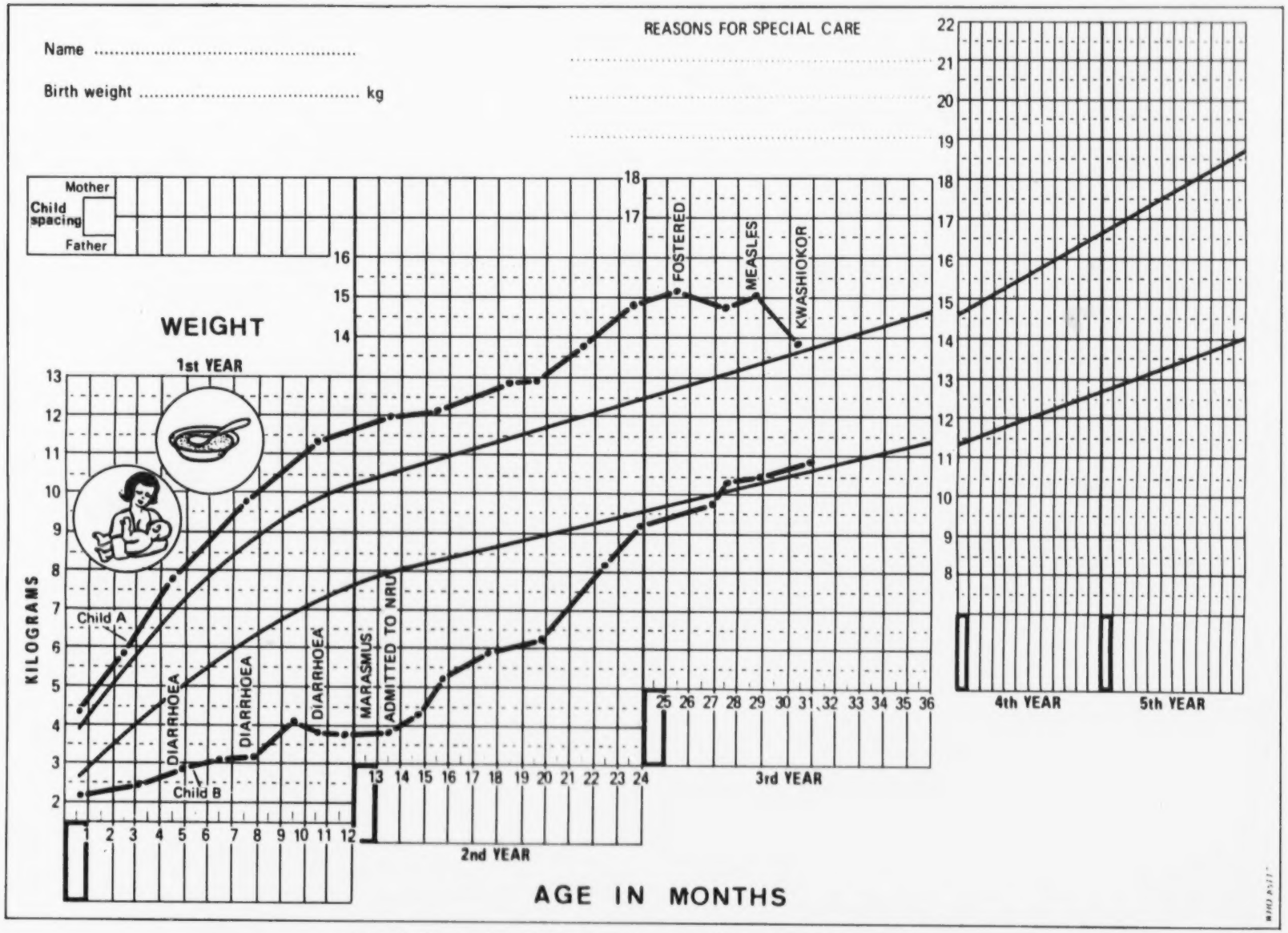


Fig. 26. Comparison of two growth curves (for explanation, see text)

It will also be necessary to answer questions or solve problems that the health workers may find in the use of the chart, and to supervise and evaluate the use of the charts and, if necessary, to modify them or the method of use. All these decisions will have to be taken in accordance with the objectives and organization of the programme in which the growth charts are going to be used. No universal guidelines can be provided, since local conditions are the determining factor.

Logistic support will include: ensuring that the cards needed are available in the amounts required; checking and maintaining the scales; and providing transport if required. As with any other programme activity, the use of the growth chart will be effectively implemented only if both the actual users and programme managers are interested, and find the charts to be helpful in their activities.

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